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A THIRD SPECIES OF *MIMOPHYTUM* S. STR. AND THREE NEW SPECIES OF *OMPHALODES* (BORAGINACEAE) FROM NORTH AMERICA

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ABSTRACT

Omphalodes richardsonii of Tamaulipas is similar in morphology and geography to the two other species of *Mimophytum*, both also from Mexico, and is transferred to that genus as **Mimophytym richardsonii** (Nesom) Nesom, **comb. nov.** The other eight North American species of *Omphalodes* remain in *Omphalodes* sensu stricto, without evidence currently available to justify their position elsewhere, although these species comprise three distinct morphological groups. Three new species are described. **Omphalodes alienoides** Nesom, **sp. nov.**, from Texas, USA, and Coahuila, Mexico, is sister to *O. aliena*; both of these species are taprooted annuals with an ebracteate inflorescence and produce dimorphic mericarps. **Omphalodes australis** Nesom, **sp. nov.**, from Puebla, Mexico, long disjunct southward from the other species of *Omphalodes*, and **Omphalodes carranzae** Nesom, **sp. nov.**, from northwestern Coahuila, both apparently are closely related to *O. cardiophylla*. A key and distribution maps for these eleven species are provided.

KEY WORDS: Boraginaceae, *Omphalodes*, *Mimophytum*, North America

A synopsis of the North American species of *Omphalodes* Mill. [1754], all from Mexico and the southcentral USA, was provided by Nesom (1988). In addition to those six species, the genus also includes about 22 more from Europe and Asia, including the type, *O. verna* Moench, of central and southeastern Europe. Three previously undescribed species from North America are added here.

The synopsis in 1988 included one previously undescribed species, *Omphalodes richardsonii* Nesom from southern Tamaulipas, which was distinguished from the others by its mericarp margins with apically glochidiate teeth. With an unfortunate lack of perspective, assessment of relationships among *O. richardsonii* and the other species did not include a consideration of the monospecific genus *Mimophytum* Greenman (1905), which also has mericarps with apically glochidiate teeth and which was noted by Greenman as a probable close relative of American *Omphalodes*. To *Mimophytum*, Perez-Calix and Patino-Siciliano (2009) added *M. benitomartinezii* Pérez-Calix & Pat.-Sicil., but they did not consider species of *Omphalodes*. The present study broadens the perspective in an appraisal of relationships among the American species.

Recent phylogenetic studies

A DNA-based study of Boraginaceae phylogeny (Weigend et al. 2013) shows the nine *Omphalodes* species in their sample divided among three independent clades. Most, however, are in the "*Omphalodes* clade," which includes six European species (annuals and perennials) as well as *O. aliena* A. Gray, the only American *Omphalodes* in their study. *Omphalodes aliena* is aligned as sister to the Andean species *Cynoglossum paniculatum* Hook. & Arn. and the monotypic genus *Myosotidium* Hook., an endemic of the Chatham Islands, New Zealand. The latter two species are the only two of the *Omphalodes* clade of Weigand et al. outside of traditionally recognized *Omphalodes*. Two elements of traditional *Omphalodes* are in lineages widely separated from the *Omphalodes* clade: the European *O. scorpioides* Schrank is closely related to species of *Mertensia* Roth; the Japanese *O. akiensis* Kadota is closely related to the Asian genus *Bothriospermum* Bunge.

Mostly using unpublished molecular data from "M. Serrano, R. Carbajal, & S. Ortiz," Heenan et al. (2010), in a small sample of species, found *Myosotidium* to be most closely related to the European *Omphalodes nitida* Hoffmanns. & Link. Using mostly the same data, Nazaire and Hufford (2012) found *Myosotidium* to be most closely related to *O. nitida* and *O. verna*. Neither Heenan et al. nor Nazaire and Hufford included *O. aliena* or *Cynoglossum paniculatum* among the samples.

Pollen morphology

Pollen morphology of *Omphalodes* from 26 taxa representing its entire geographic range (Europe, Eurasia, Japan, North America) was studied by Coutinho et al. (2012). They found three distinct morphological types: (1, "Japanese type") the Japanese species have pseudocolpi and colpori with granulate margins and a ringlike aperture; (2, "verna type") the American *O. aliena* and *O. richardsonii* and all European and Eurasian species except one (the Eurasian *O. lojkae* Somm. & Lev.) also have pseudocolpi and colpori with granulate margins but a ringlike aperture is absent; (3, "chiangii type") the American *O. cardiophylla*, *O. chiangii*, *O. erecta*, and *O. mexicana*, as well as *O. lojkae*, have non-granulate pseudocolpi and colpori and lack a ringlike aperture.

Taxonomic overview

Specimens of American *Omphalodes* borrowed from herbarium TEX-LL in Austin have recently been returned — five species (*O. aliena*, *O. cardiophylla*, *O. chiangii*, *O. erecta*, and *O. mexicana*) were annotated in May 2013 by "M. Serrano (SANT)" with unpublished combinations in *Mimophytum* attributed to "M. Serrano, R. Carbajal & S. Ortiz." Specimens of *Omphalodes richardsonii*, however, were not annotated. Working from the Royal Botanic Garden in Edinburgh, R.R. Mill in 2005 annotated (at TEX-LL and at least also at GH) types of *O. aliena*, *O. cardiophylla*, *O. chiangii*, *O. mexicana*, and *O. richardsonii* with unpublished combinations in *Mimophytum* (see further notes below); he annotated the type of *O. erecta* with an unpublished combination in a previously undescribed genus.

The current study does not include first-hand observation of extra-American species, and published molecular studies have included only *Omphalodes aliena* among the American species. Without a broader perspective, a proposal for taxonomy at the genus level is not justified here.

Among the American species considered here (*Mimophytum* and *Omphalodes*), four morphological groups are evident.

* *Omphalodes erecta*

This species is distinct from all others in its combination of tall, stiffly erect stems, large, elliptic to elliptic-oblanceolate leaves with an acute to short-acuminate base, large flowers in an ebracteate inflorescence, tuberculate corollas, and solitary nutlets (3 of 4 consistently aborting). I have not seen a collection with unambiguous below-ground parts, but the plants appear likely to arise from a lignescent rhizome. Pollen of *O. erecta* is "chiangii-type." Johnston's comments in the protologue of *Omphalodes erecta* (1935, p. 205) are these:

> "A remarkable species differing from all its congeners in its coarse erect habit of growth. The genera habit and appearance of the plant, indeed, is more suggestive of *Cynoglossum* than of *Omphalodes*. From the American species of its genus it is further distinguished by its large solitary nutlets which possess a weakly denticulate and spreading wing, rather than a strongly toothed upcurved one. The foliage of *O. erecta* is very distinctive. All the American species of the genus have long-petioled more or less cordate leaves. The new species has them very short-petioled and lanceolate. Only one Mexican species, *O. aliena*, has a similar bractless inflorescence."

Collections of *Omphalodes erecta* were identified and annotated by R.R. Mill in 2005 as comprising a new genus. Treating this species as a separate genus seems reasonable in view of its highly distinctive morphology.

* *Omphalodes aliena* and *O. alienoides*

These two species are distinct in their annual duration, all stems arising from a multicipital caudex at the top of a slender taproot (Figs. 1, 2), and their ebracteate inflorescence, ring of tubercles around the corolla throat, and dimorphic mericarps (Figs. 3, 4). Other American species are perennial and rhizomatous and have monomorphic mericarps; *Omphalodes erecta* has an ebracteate inflorescence and tuberculate corollas. Pollen of *O. aliena* (and presumably *O. alienoides*) is "verna-type" like most of the European and Eurasian species. Among the American species, *O. aliena* and *O. alienoides* together are at least as distinctive as *O. erecta*.

* *Omphalodes australis*, *O. carranzae*, *O. chiangii*, *O. cardiophylla*, and *O. mexicana*

These species are rhizomatous perennials with lax stems, ovate-cordate leaves, bracteate inflorescence, and monomorphic nutlets. In their "chiangii-type" pollen (*Omphalodes australis* and *O. carranzae* have not been examined), they are more closely similar among themselves than to *O. aliena*. On the other hand, *O. erecta* and the Eurasian *O. lojkae* also have "chiangii-type" pollen.

* *Mimophytum omphalodoides*, *M. benitomartinezii*, and *Omphalodes richardsonii*

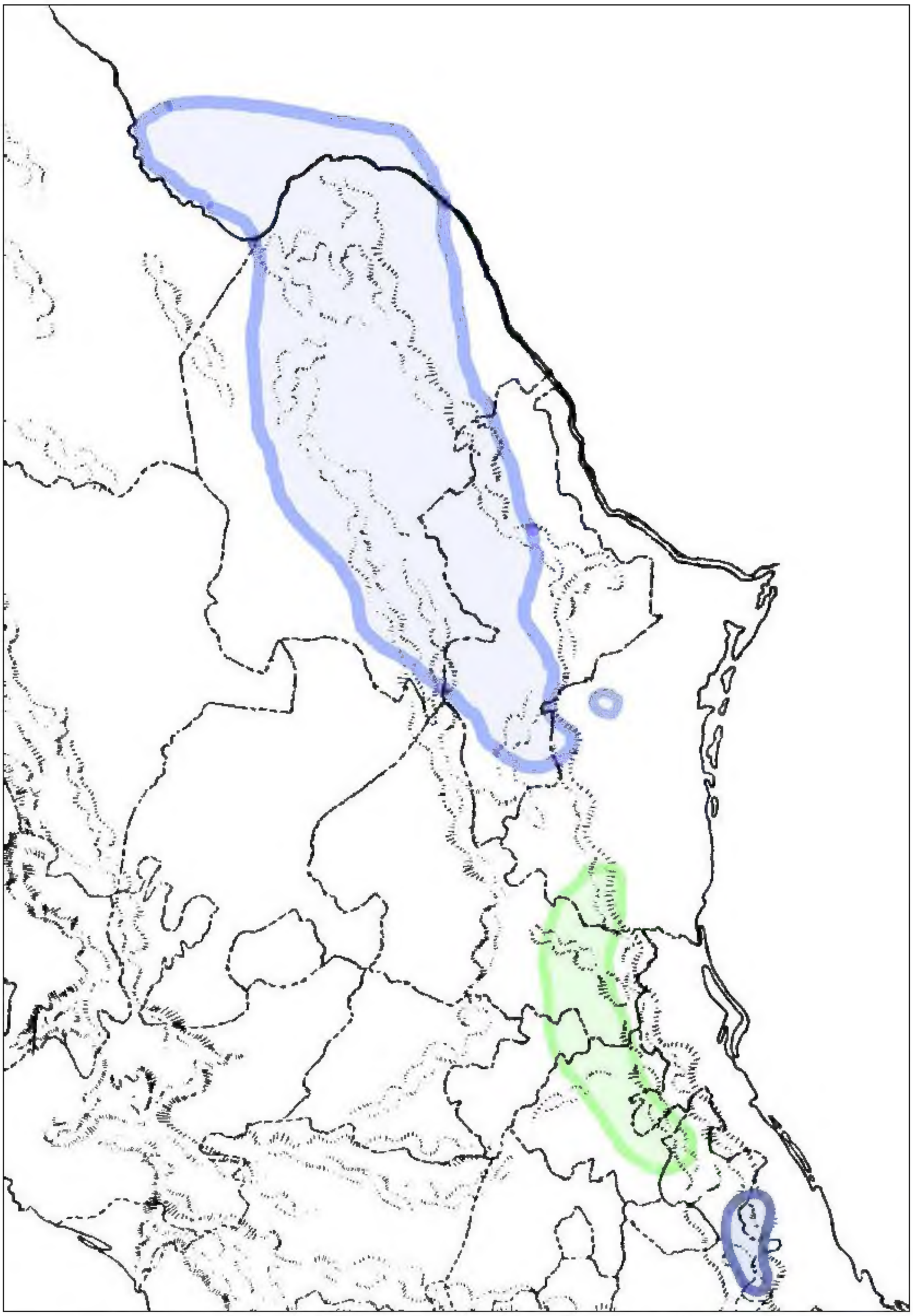
The glochidiate mericarp margins common to *Omphalodes richardsonii* and the two species of *Mimophytum*, along with the geographic coherence of those three species (Maps 1, 2), support a hypothesis that they are closely related. In fact, they apparently are the only species among all *Omphalodes* worldwide with this morphological feature. The other American species of *Omphalodes* have mericarps with straight hairs (sometimes apparently greatly reduced or absent), similar to *Omphalodes* in Europe and Asia, and as a group (with the exception of *O. australis*) they have a more northern distribution (Maps 1–4) and occur in more arid habitats.

Without infringing on the intention of Mill or of the Serrano group to expand *Mimophytum* (in accordance with their recent annotations), or even contrary, apparently, to their intention, *Omphalodes richardsonii* is here transferred to *Mimophytum*, while the remaining American species are left in *Omphalodes*. Given the strong predictivity of geography in phylogenetic analysis, it is not unreasonable to suppose that the whole group of American species is monophyletic and that all of them may eventually be placed in *Mimophytum*, but evidence to justify that is not available.

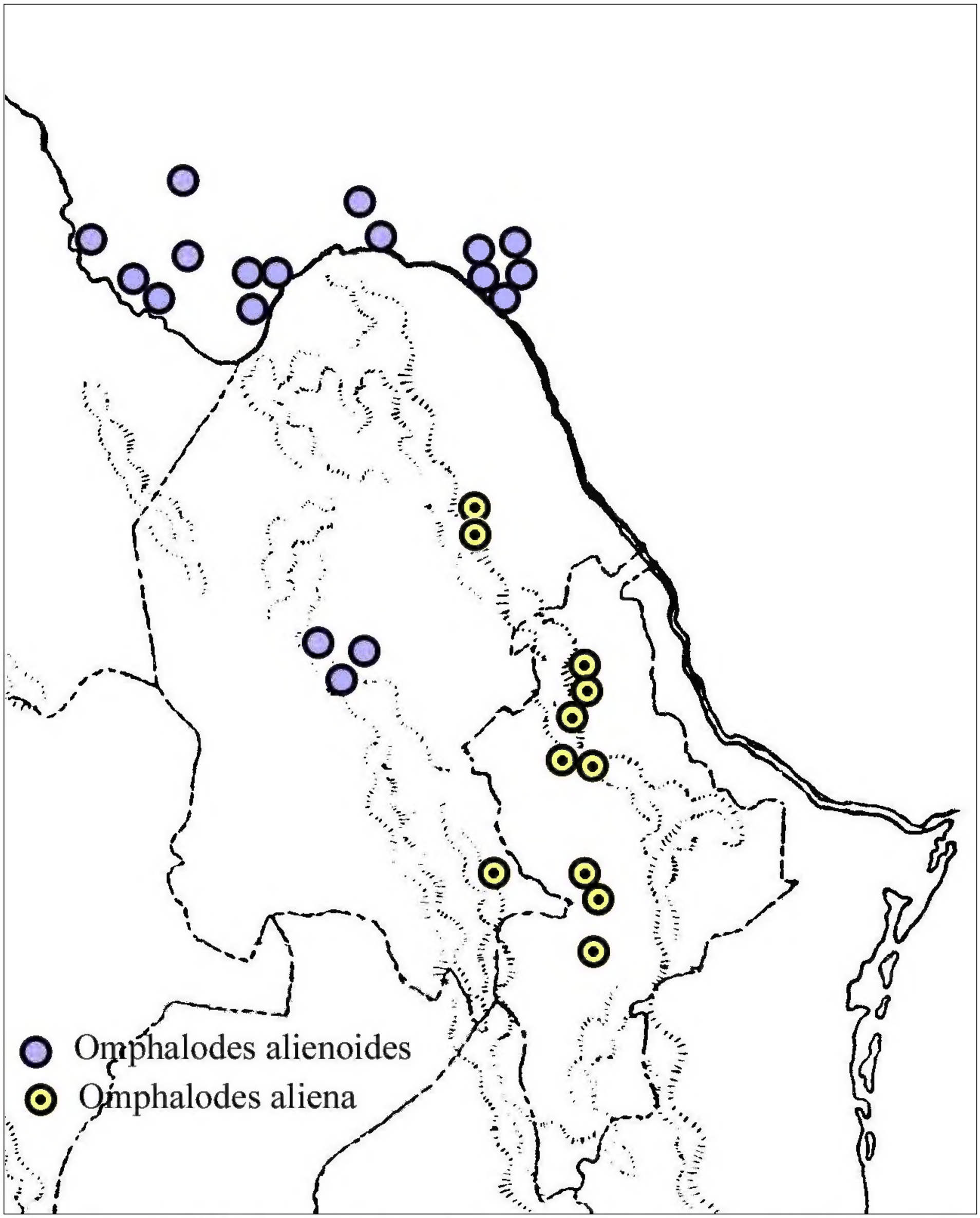
The South American *Cynoglossum paniculatum* also has fruits with glochidiate-tipped spinules (the fruits are neither flattened nor have distinct margins, and they are evenly covered with spinules). Development of glochidiate hairs apparently has arisen a number of times in parallel in Boraginaceae, but within the strongly supported *Omphalodes* clade sensu Weigend et al. (2013), the occurrence of glochidiate hairs is perhaps most parsimoniously interpreted as a synapomorphy indicating common ancestry of *C. paniculatum* and *Mimophytum*.

For consistency in the context of this taxonomy, if further evidence indeed supports *Cynoglossum paniculatum* as sister to *Mimophytum* sensu stricto, it should be treated at generic rank (possibly including the two other native South American species identified as *Cynoglossum*, *C. trianaeum* Wedd. and *C. limense* Willd. (Johnston 1927; both species recognized as extant in various South American floristic accounts). This would imply that retention of *Myosotidium* at generic rank also is warranted and in turn that further subgroups of *Omphalodes* might be similarly segregated. It is unlikely that the whole *Omphalodes* clade would be considered a single genus.

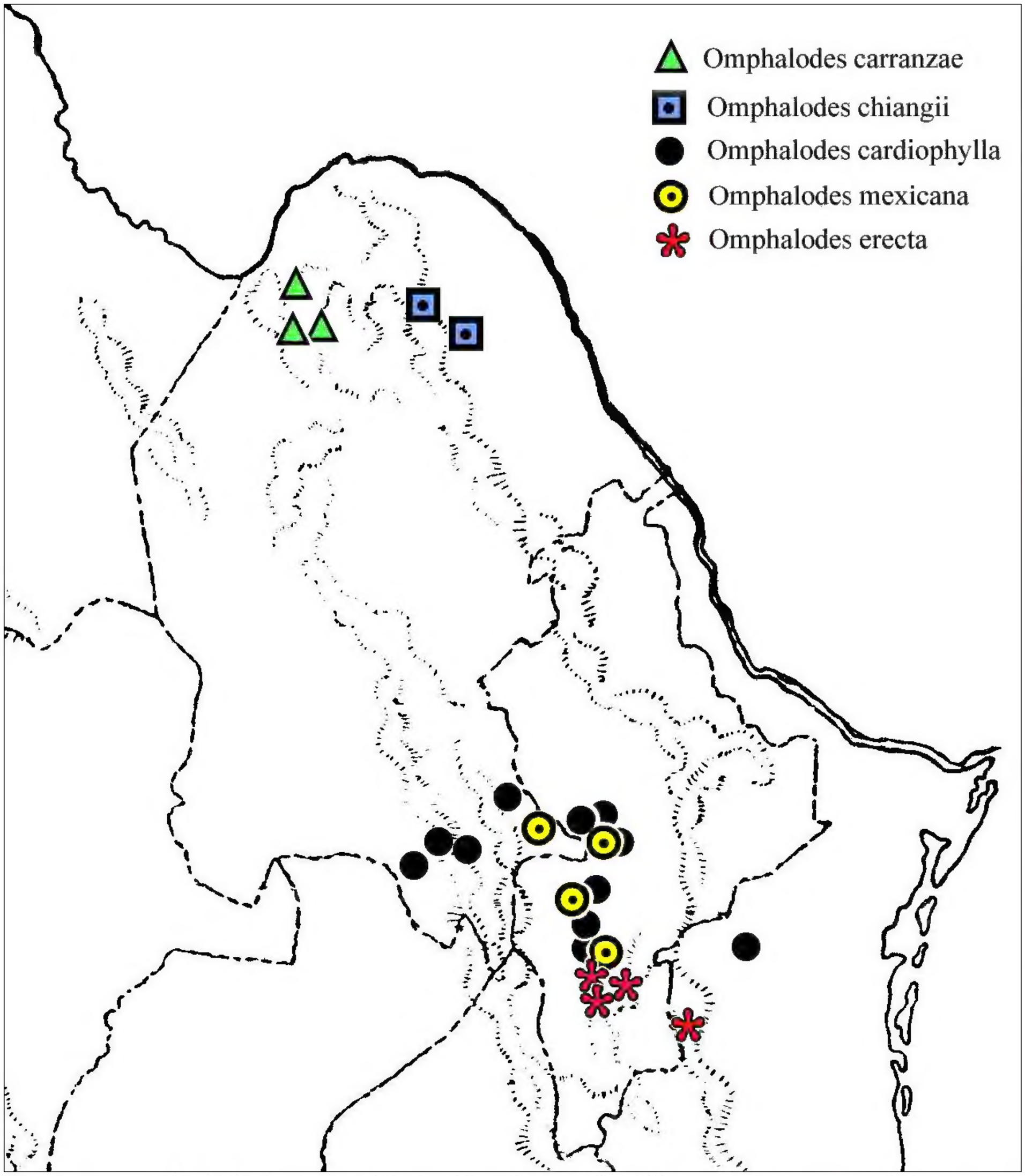
It is at least possible that the recently described monotypic genus *Oncaglossum* Sutorý (Sutorý 2012), based on *Cynoglossum pringlei* Greenm. of central Mexico, is closely related to the *Omphalodes* clade. *Cynoglossum pringlei* has not been included in published molecular analyses.



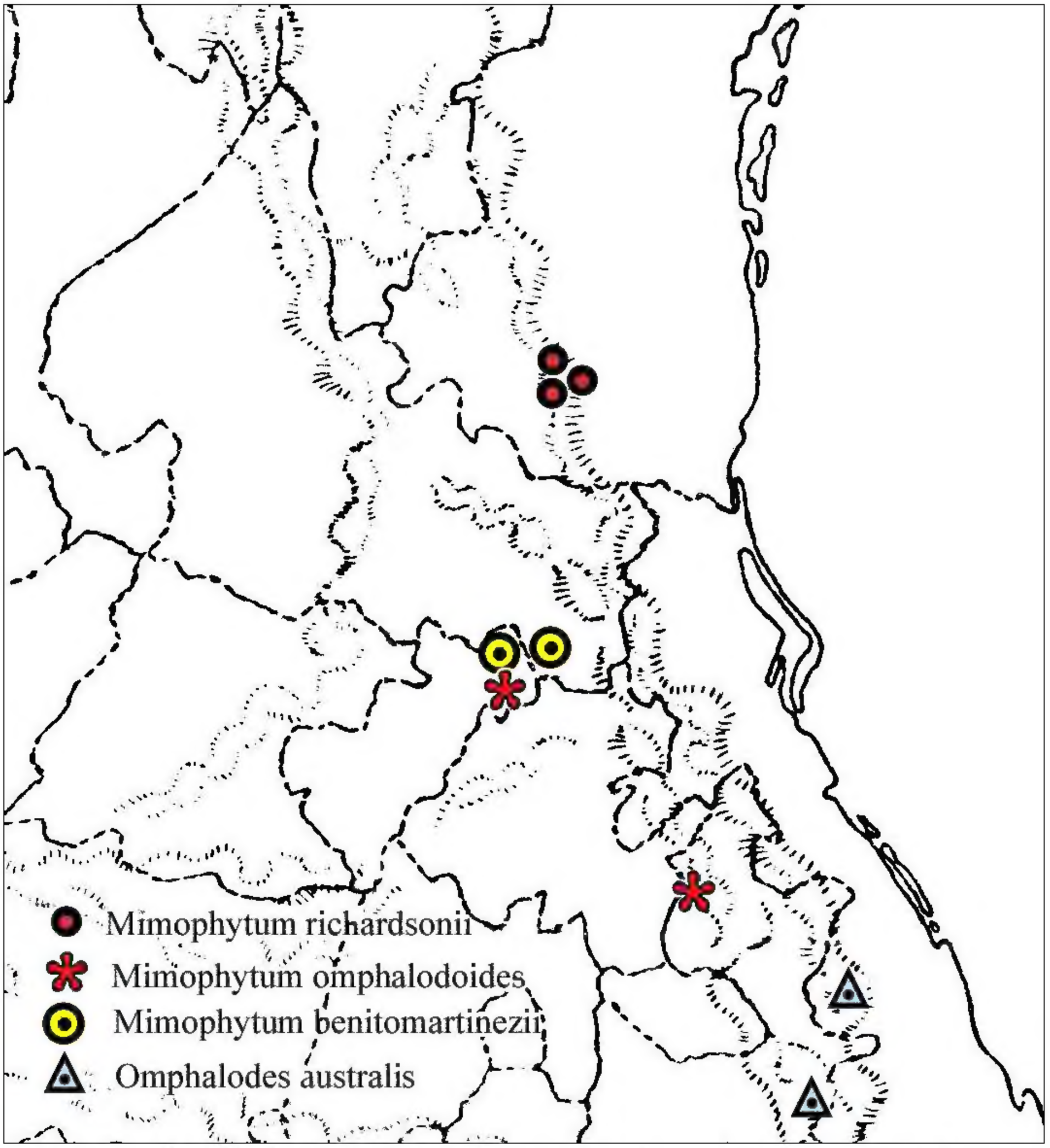
Map 1. General range outlines of *Mimophytum* (green) and North American *Omphalodes* (blue).



Map 2. Geographic distribution of *Omphalodes aliena* and *O. alienoides*. *Omphalodes alienoides* in Texas is documented from Brewster, Presidio, Terrell, and Val Verde counties.



Map 3. Geographic distribution of *Omphalodes chiangii*, *O. cardiophylla*, *O. erecta*, and *O. mexicana*. All are in the Mexican states of Coahuila, Nuevo León, and Tamaulipas.



Map 4. Geographic distribution of *Mimophytum benitomartinezii*, *M. omphalodoides*, *M. richardsonii*, and *Omphalodes australis*. The record for *O. australis* is Veracruz is not certain (see comments in text).

KEY TO AMERICAN SPECIES OF MIMOPHYTUM AND OMPHALODES

1. Marginal nutlet teeth apically glochidiate, otherwise glabrous.

2. Upper surface surface of nutlet with apically glochidiate, toothlike appendages ..... 1. **Mimophytum omphalodoides**
2. Upper surface surface of nutlet without toothlike appendages, glochids marginal only.

3. Leaves mostly basal; inflorescence ebracteate ..... 2. **Mimophytum benitomartinezii**
3. Leaves mostly cauline; inflorescence bracteate ..... 3. **Mimophytum richardsonii**

1. Marginal nutlet teeth glabrous, minutely papillate, or hispid to hispid-hirsute over the whole surface, not apically glochidiate.

4. Leaves elliptic to lanceolate with an acute to short-acuminate or rounded base; stems stiffly erect, 25–50 cm ..... 3. **Omphalodes erecta**
4. Leaves ovate, usually with a cordate to subcordate base (cuneate in *O. mexicana*); stems lax, usually decumbent to ascending, 10–35 cm.

5. Taprooted, annual to short-lived perennial; inflorescence ebracteate; corollas with a ring of tubercles around the throat; mericarps dimorphic.

6. Stems strigose in distal 1/3, densely pilose below, hairs 0.5–2 mm long; petioles densely pilose; sepals often with blue-pigmented epidermis distally and with blue-jointed hairs ..... 1. **Omphalodes aliena**
6. Stems sparsely strigose proximal to distal, hairs 0.2–0.4 mm long; petioles sparsely hirsute; sepals green, hairs without colored joints ..... 2. **Omphalodes alienoides**

5. Rhizomatous, perennial; inflorescence bracteate; corollas without tubercles; mericarps monomorphic.

7. Leaf blades cuneate basally, surfaces densely pilose-cinereous leaves; mericarps glabrous, margin shallowly, minutely, and irregularly crenate-serrate ..... 5. **Omphalodes mexicana**
7. Leaf blades usually cordate basally, surfaces sparsely to moderately strigose, hairs distinctly appressed at least on lower surface; mericarps glabrous or hairy, margin entire or prominently toothed.

8. Mericarp wing entire ..... 7. **Omphalodes chiangii**
8. Mericarp wing prominently toothed.

9. Stem vestiture pilose proximally ..... 4. **Omphalodes cardiophylla**
9. Stem vestiture strigose proximally to distally.

10. Corolla limb blue; mericarps 4; Coahuila ..... 7. **Omphalodes carranzae**
10. Corolla limb white; mericarps 1; Puebla/Veracruz ..... 8. **Omphalodes australis**

MIMOPHYTUM Greenm., Proc. Amer. Acad. Arts 41: 242. 1905. **TYPE**: *Mimophytum omphalodoides* Greenm.

Perennial, rhizomatous, stems lax, trailing; leaves ovate to ovate-cordate; mericarps monomorphic, fruit teeth or tooth-like appendages of the fruit surface glochidiate-tipped.

Mimophytum omphalodoides was noted by Greenman to be similar to *Omphalodes* species except in the *Cynoglossum*-like fruit morphology, presumably in reference to the "spines" with glochidiate apices and the distribution of the spines the whole fruit surface.

> "The plant here described but for the character of the fruit might well be placed under the genus *Omphalodes*, being in habit and superficial characters almost the counterpart of *O. acuminata* Rob. [= *O. cardiophylla*]. The fruit, however, bears a striking contrast to the saucer-like nutlet of *Omphalodes*. It is on the other hand more like that of *Cynoglossum*, but is more distinctly discoid, and bears the glochidiate spines on the upper side only. The trailing habit, moreover, is quite unlike anything known in *Cynoglossum*. On the whole it seems best to characterize the plant in question as a new genus based on the technical characters of its fruit and its habit, occupying a position in the order somewhat intermediate between *Omphalodes* and *Cynoglossum*" (Greenman 1905, p. 243).

The mericarps of *Myosotidium omphalodoides* are flattened like those of *M. benitomartinezii* and *M. richardsonii*, and they also have a distinct, flat, somewhat thickened, winglike margin. The erect, narrowly elongate, glochidiate-tipped teeth are positioned evenly around the margin as well as on the central portion of the upper surface.

1. *Mimophytum omphalodoides* Greenm., Proc. Amer. Acad. Arts 41: 242. 1905. **TYPE**: **MEXICO. Puebla**. Under wet cliffs in the barranca below Honey Station, 5000 ft, 24 May 1904, *C.G. Pringle 8822* (holotype: GH; isotypes: E-3 sheets, F digital image!, GH, K, M, MEXU-3 sheets digital image, MO digital image!, MSC, NY-2 sheets digital image!, PH, S). The GH holotype is annotated by Greenman; the isotype is from the herbarium of Albert Hanford Moore, given to GH in 1927.

2. *Mimophytum benitomartinezii* Pérez-Calix & Pat.-Sicil., Acta Bot. Mex. 87: 93. 2009. **TYPE**: **MEXICO. Querétaro**. Mpio. Jalpan: ca. 3 km S of Valle Verde, cerro El Pilón, 1350 m, 16 Feb 2001, *E. Pérez C. & A. Patiño 4117* (holotype: IEB digital image!; isotypes: ENCB digital image!, MEXU digital image!).

3. **Mimophytum richardsonii** (Nesom) Nesom, **comb. nov.** *Omphalodes richardsonii* Nesom, Sida 13: 27. 1988. **TYPE**: **MEXICO. Tamaulipas**. Mpio. Gómez Farías: area of Rancho del Cielo, ca. 3.5 km NW of Gómez Farías, Aguacates grade, 29 Mar 1969, *A. Richardson 1148* (holotype: TEX!). The holotype was annotated in 2005 by R.R. Mill as "Mimophytum richardsonii," but the name has never been published.

OMPHALODES Mill., Gard. Dict. Abr. (ed. 4), 28. 1754. **TYPE**: *Omphalodes verna* Moench

Perennial, rhizomatous, or (*O. aliena* and *O. alienoides*) annual to short-lived perennial, taprooted; mericarps dimorphic or monomorphic; fruit teeth minutely papillate to hispid or hispid-hirsute, without a glochidiate or uncinate apex.

1. *Omphalodes aliena* A. Gray in Hemsl., Biol. Centr. Amer. Bot. 2: 377. 1882. **TYPE: MEXICO. Nuevo León**. Monterrey, Feb 1880, *E. Palmer 893* (holotype: K digital image!; isotypes: F digital image!, GH!, K digital image!, NY digital image!, PH digital image!, YU). The holotype was annotated in 2005 by R.R. Mill as "Mimophytum aliena," but the name has never been published.

Mericarp morphology. TYPE A: wings thin-translucent, teeth spreading in the same plane as the wing, shallowly dentate, glabrous, apex rounded, adaxial surface glabrous or with a few, thickened, papillate hairs, abaxial surface glabrous to sparsely papillate; TYPE B: wings thickened-opaque, teeth erect, mostly oblong, hirsutulous especially at apex, apex truncate, adaxial surface hirsutulous, abaxial surface hispidulous; mericarp types 2+2, 3+1, or all 4 of a single type. Figure 4.

Omphalodes aliena was described as annual by I.M. Johnston (1964; 1970) and as "Annual/perennial" by Coutinho et al. (2012). Present observations agree that the plants are annual to perhaps short-lived perennial. The species is distinct from other North American *Omphalodes* in its taprooted habit, shorter duration, ebracteate inflorescence, dimorphic nutlets, and pollen type. Previous descriptions have included both *O. aliena* and the species newly segregated here as *O. alienoides*, but they are nearly identical in overall aspect, differing primarily in vestiture and in nutlet morphology.

2. **Omphalodes alienoides** Nesom, **sp. nov.** Figures 1, 2, 3, 5. **TYPE: USA. Texas**. Val Verde Co.: N-facing ledge of Pecos River below the park overlooking the mouth of the river, corolla light blue at the edge and white in the center, 3 Apr 1965, *D.S. Correll and H.B. Correll 30816* (holotype: LL!, Fig. 1).

Similar to *Omphalodes aliena* A. Gray but distinct in its strigose cauline vestiture of shorter hairs, sparsely hirsute petioles, and nutlets (both forms of the dimorphic pair) of different morphology.

Annuals or possibly short-lived perennials, taprooted. **Stems** (1–)2–10, all originating from a multicipital caudex, lax, erect-ascending to decumbent-ascending, 10–32 cm, sparsely strigose with antrorsely appressed hairs 0.2–0.4 mm long, sometimes hirsutulous on proximalmost portions. **Leaves** basal and low cauline, blades ovate to broadly ovate, depressed-ovate, or elliptic-ovate, (6–)10–30 mm, base truncate to silghtly cordate, upper and lower surfaces hirsute with hairs from pustulate bases, petioles 6–50 mm, sparsely hirsute. **Inflorescence** ebracteate racemes, (2–)6–15-flowered, axis elongating to 6–22 cm in fruit; fruiting **peduncles** (5–)10–15(–20) mm, spreading to slightly deflexed. **Sepals** narrowly lanceolate to linear-lanceolate, 1.5–2.5 mm, green, stiffly strigose with whitish hairs. **Corollas** 6–8 mm in diameter, limb sky blue with 5 thick, yellow tubercles surrounding tube orifice, tubercled orifice encircled by a narrow white area (Fig. 5), limb rarely white in mixed populations with blue-flowered forms (as noted on label of *McVaugh 7751*). **Mericarps** 4, all maturing, dimorphic (Fig. 3) — TYPE A: teeth erect, relatively shorter, oblanceoid to obovoid or club--shaped, minutely papillate, apex blunt, adaxial surface glabrous or with a few, thickened, papillate hairs, abaxial surface glabrous to papillate; TYPE B: teeth erect, relatively longer, narrowly lanceoid, hirsutulous, apex acute, adaxial surface hirsutulous, abaxial surface hirsute to hispidulous; mericarp types 2+2, 3+1, or all 4 of a single type.

Flowering Mar–Apr. Limestone bluffs, cliffs, crevices, and ledges, limestone and gypsum slopes, calcareous gravel and talus slopes, steep-sided canyon bottoms, sandy banks, stream sides in gravel, sand and silt, desert shrub, stream terrace woodlands, mesic canyon woodlands; (400–)500–750 in Texas, 1000–1400 m in Coahuila; south-central Texas, apparently disjunct southward to central Coahuila.

Additional collections examined. **MEXICO**. **Coahuila**. Canyon E side of Sierra de las Margaritas ca 13 km N of Las Margaritas, 1100–1400 m, limestone and gypsum slopes, also limestone gravel arroyo, matorral desertico inerme, also some mesquital, *Larrea*, *Viguiera stenoloba*, *Parthenium incanum*, *Agave lechuguilla*,

Hechtia, 23 Mar 1973, *Johnston, Wendt, & Chiang 10357A* (TEX), ca 1 km W of Las Delicias at and near spring, top of alluvial fan on side of mountain, 1000-1300 m, calcareous gravel somewhat gypsiferous fan and limestone mountainsides, matorral desertico inerme, also some mesquital, *Larrea tridentata*, *Flourensia cernua*, *Parthenium incanum*, *Viguiera stenoloba*, 24 Mar 1973, *Johnston, Wendt, & Chiang 10390* (TEX), Cuatro Cienegas Basin, tip of Sierra San Marcos, ridge, campsite, 3 Apr 1969, *Lehto, Keil, & Pinkava 6180* (ASU digital image, TEX), 18 km SW of Cuatrocienegas, 27 Mar 1992, *Neff 92-3-27-1* (TEX), Cuatro Cienegas Basin, Sierra San Marcos, NE-facing slope, near tip of mountain, bajada and mountain slopes, desert shrub, 19 Mar 1973, *Pinkava 10369* (ASU digital image, TEX), lomerias cercanos a la Poza de la Becerra en Cuatro Cienegas, veg de *Agave lechuguilla*, *Agave greggii*, *Larrea*, *Viguiera stenoloba*, 7 Apr1984, *Rodriguez y Carranza 1348* (ANSM fide J Villarreal, TEX), Cañon de Jora, along road, 5 3 mi E of Est Los Belloc and 3 8 mi W of Est Socorro turnoff, major desert arroyo in low limestone canyon area with *Chilopsis*, *Celtis pallida*, *Acacia berlandieri*, *Lycium berlandieri*, *Acacia neovernicosa*, *Viguiera stenoloba*, *Porophyllum scoparium*, 1050 m, 19 Mar 1977, *Wendt, Lott, & Olmstead 1961* (TEX) **USA Texas** Brewster Co On N-facing slopes of Bullis Range, in the vicinity of Bullis Gap, on the Bullis Gap Ranch, infrequent annual herb among rock crevices, 17 May 1977, *Butterwick & Lott 3601* (TEX), Boquillas Canyon (ca 10 mi below W entrance), 11 Feb 1965, *Correll & Douglas 30715* (LL), Reagan Canyon, ca 1 mi above mouth, 500 600 m, USGS, Reagan Canyon Quad, steep rocky (limestone) slopes, abundant, 4 Apr 1947, *McVaugh 7808* (TEX), Burro Bluff, bluff on the Rio Grande (across from Tule Canyon, Coahuila), high limestone bluff, talus slopes, limestone gravel, associates *Aloysia*, *Acacia*, *Rhus*, *Karwinskia*, *Agave*, *Hechtia*, *Euphorbia antisiph* , *Opuntia*, 21 Mar 6 Apr 1973, *Riskind 1009* (LL), Santa Helena Canyon ledges, 19 Mar 1941, *Warnock 21579* (TEX) Presidio Co N-facing cliffs, 15 mi SE of Redford, on limestone cliffs, 14 May 1959, *Correll & I.M. Johnston 21915* (LL), ca 15 mi SE of Redford, in shade of bluffs, in canyon, 21 Apr 1961, *Correll & Rollins 23704* (LL) Terrell Co N side of current channel of Independence Creek, S side of Independence Creek Rd from a point 3 6-3 7 road mi E of jct St Rte 349, Oasis Ranch Preserve, Oasis Ranch Quadrangle, common in tightly packed riverwashed gravel, sand and silt, in shade of thicket on floodplain, 1960 ft, associates include *Juglans microcarpa*, *Morus* sp , *Celtis reticulata*, 4 Apr 2001, *Carr 19471* (TEX), in short N-draining canyon on S side of Independence Creek, ca 3 5-2 6 air mi E to ESE of jct Independence Creek Rd and St Rte 349, Oasis Ranch Preserve (TNC), Oasis Ranch Quadrangle, common among *Quercus pungens* var *vaseyana*, *Juniperus pinchotii*, *Diospyros texana* and other tall shrubs on rocky slopes and bottom of steep-sided canyon cut into plateau of Edwards Limestone, 2000 2200 ft, in spring 2001, this species was abundant in stream terrace woodlands and locally frequent to common in mesic canyon woodlands, 5 Apr 2001, *Carr 19513* (TEX), Sanderson, common and abundant on rocky hillsides, 15 Mar 1919, *Hanson 381* (TEX), Morton Canyon, Rio Grande ca 25 mi S of Dryden, rocky limestone bluffs at dam site, 1 Apr 1947, *McVaugh 7751* (TEX) Val Verde Co Pump Canyon, Langtry, on ledges, 15 Apr 1961, *Correll & Rollins 23575* (LL), W side of Pecos River below Pandale, at road-crossing 26 mi N of Langtry, sandy bank, scattered, but quite abundant, 30 Mar 1947, *McVaugh 7712* (TEX), canyon of Pecos River 1 mi above mouth, at crossing of route US 90, steep rocky limestone slopes, abundant, 29 Mar 1947, *McVaugh 7699* (TEX), W wall of Pecos River Canyon, in small draw between limestone bluffs, 23 Mar 1941, *Rose-Innes & Warnock 603* (TEX), at mouth of Pecos River, frequent atop limestone bluffs, 29 Mar 1947, *Warnock and McVaugh 47200* (TEX), Mile Canyon, Langtry, limestone soil, 1300 ft, frequent annual, 10 Apr 1949, *Warnock, Parks, & Turner 224* (LL)

In the earlier study of *Omphalodes* (Nesom 1988), I mentioned variability in mericarp morphology in *O. aliena*, but not understanding that two species were involved, the two forms of *O. alienoides* were illustrated in Figures 2a and 2b; the TYPE A form of typical *O. aliena* was illustrated in Figure 2c. Notations in 2005 by R.R. Mill on two specimens of *O. alienoides* from Coahuila indicate that he also was aware of the variation in mericarp morphology — he annotated these collections, but not the conspecific ones from Texas, as an undescribed species. Long before, in the protologue of *O. aliena*, Asa Gray made this perceptive observation: "We think there can be no doubt that the nucules of this species are dimorphic, the wing in a few of the lower ones being thickened, hispid, and turned back, and in the rest thin, glabrous, and flat." His description was drawn from the type collection (*Palmer 893*) from near Monterrey and did not include plants from Texas or Coahuila.

In each of the two species, each mericarp form shows variation but the distinction between the two forms is entirely consistent, as is the distinction between mericarp pairs of the two species.

LL
copyright reserved
LUNDELL HERBARIUM
The University of Texas at Austin
CITE: LL
TYPE OF
Omphalodes alienoides Nesom
The University of Texas Herbarium (LL, TEX)
Omphalodes aliena A. Gray
Det B. L. Turner, 14 Apr 1997
UNIVERSITY OF TEXAS HERBARIUM TEX-LL
Omphalodes aliena A. Gray
Det. by: Guy Nesom, 1987
Omphalodes aliena Gray
Larry C. Higgins 1976
LTS
PLANTS OF TEXAS
Omphalodes aliena Gray
Val Verde Co.- North-facing ledge of Pecos River below the park overlooking the mouth of the river.
Corolla light blue at the edge and white in the center.
D. S. Correll & Helen B. Correll
No 30816 Date April 3, 1965
00035424

Figure 1 *Omphalodes alienoides, Correll and Correll 30816*, holotype LL

Figure 2 *Omphalodes alienoides, Carr 19513* (TEX) from Terrell Co., Texas

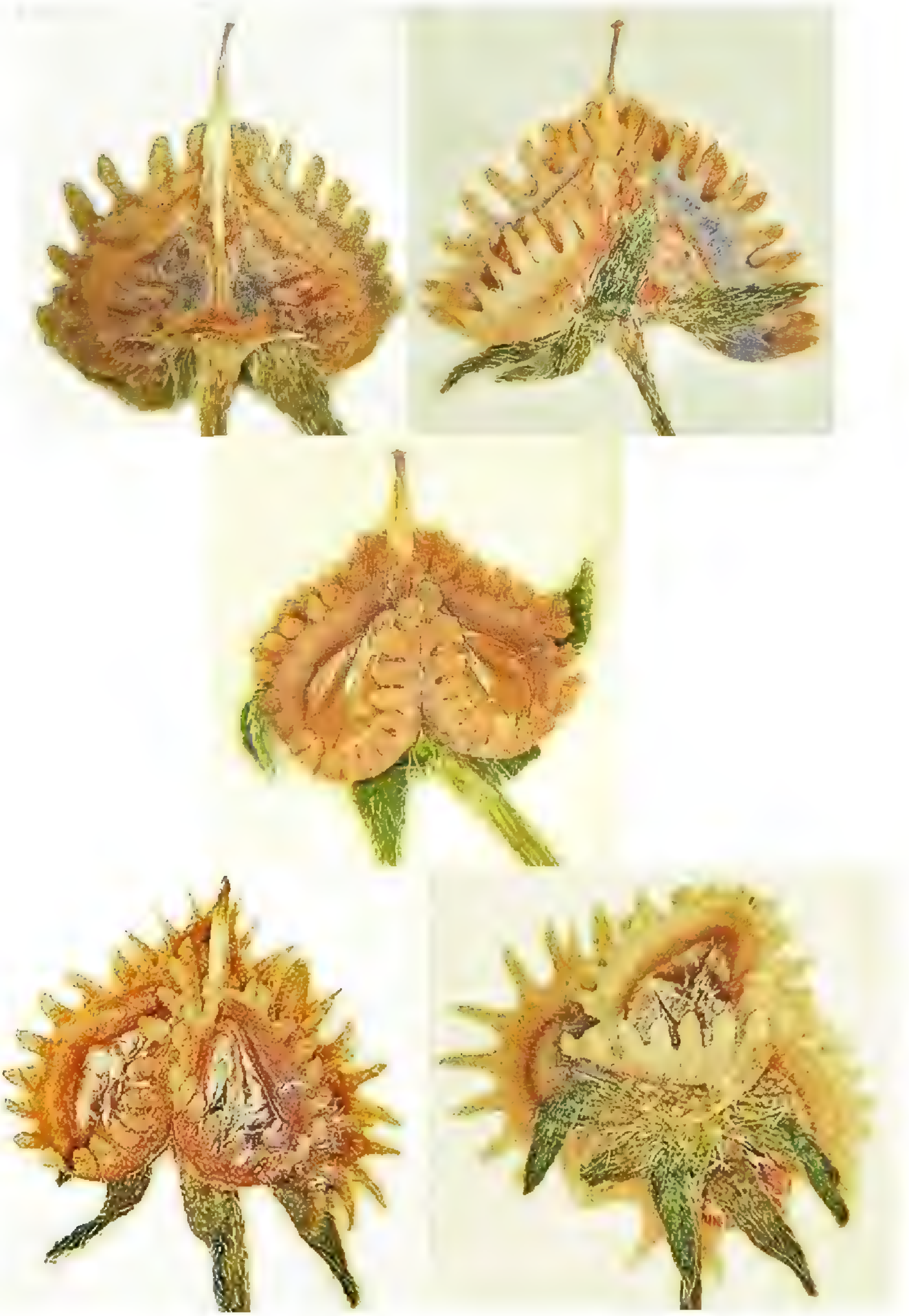


Figure 3. Dimorphic mericarps of *Omphalodes alienoides*. **A**. 2 TYPE A, showing whole gynophore. **B**. All 4 TYPE A. **C**. All 4 TYPE A. **D**. Front 2 TYPE A, back 2 TYPE B. **E**. 3 of TYPE A, back 1 TYPE B.

Figure 4. Dimorphic mericarps of *Omphalodes alıena*. A. All TYPE B, only 2 visible. B. Front TYPE B, back 2 Type A, one apparently already shed. C. All 4 TYPE A. D. All 4 TYPE A.

Figure 5. *Omphalodes alıenoıdes*, Brewster Co., Texas, 30 Dec 2004. Photos by Patrick J. Alexander.

3. *Omphalodes erecta* I.M. Johnston, J. Arnold Arbor. 16: 204. 1935. **TYPE: MEXICO. Nuevo León**. Alamar to Taray, ca. 15 mi SW of Galeana, common in dense oak wood along an arroya near Santa Ana, 3 Jul 1934, *C.H. Mueller & M.T. Mueller 992* (holotype: GH!; isotypes: F digital image!, MICH digital image!, TEX!). The isotype was annotated in 2005 by R.R. Mill with a nomenclatural combination in a previously undescribed genus.

Stems 25 50 cm tall, stiffly erect, pilose. **Leaves** elliptic to elliptic-oblanceolate, lanceolate, or broadly lanceolate, 5 11 cm x 1.5 3 cm, relatively even-sized upward or slightly reduced up to the inflorescence, base acute to short-acuminate or rounded. **Inflorescence** ebracteate, 4–20-flowered, sometimes branched at the very base and forming two axes. **Corollas** blue, limb 12–14 mm in diam., with a ring of tubercles around the throat. **Mericarp** solitary (3 of 4 consistently aborting), ca. 8 mm in diam, wing spreading, margin shallowly denticulate.

4. *Omphalodes cardiophylla* A. Gray in Hemsl., Biol. Centr. Amer. Bot. 2: 377. 1882. **TYPE: MEXICO. Coahuila**. Mountains near Saltillo, Jul 1880, *E. Palmer 894* (holotype: K digital image!; isotype: GH!, NY digital image!, US digital image!). The holotype was annotated in 2005 by R.R. Mill as "Mimophytum cardiophyllum," but the name has never been published.

Omphalodes acuminata B.L. Rob., Proc. Amer. Acad. Arts 26: 170. 1891. **TYPE: MEXICO. Nuevo León**. Sierra Madre near Monterrey, 22 Jun 1888, *C.G. Pringle 1878* (holotype: GH!, isotype: E).

Omphalodes cardiophylla is distinct in its leaves strongly cordate at base, stems sparsely pilose from top to bottom or loosely strigose in distal 1 3 and pilose proximally, with hairs 0.8–2 mm long, corollas white with limbs 10–14 mm in diameter, and monomorphic mericarps, the teeth lanceolate to oblong-lanceolate, hirsutulous to hispidulous, turned inward (not erect), abaxial surface hirsutulous to sparsely puberulent, adaxial surface minutely and inconspicuously puberulent.

The outlying population system in Tamaulipas (Map 4) is represented by these **MEXICO Tamaulipas** Mpio San Carlos Sierra de San Carlos, ca 5 mi S of San Carlos, N side of Bufa El Diente, igneous bedrock, N-facing slope, 1020 1200 m, woods of *Quercus*, *Cercis*, *Ungnadia*, *Ptelea*, *Persea*, *Croton*, *Forestiera*, Rubiaceae, abundant *Ostrya*, scattered *Carya* and *Abies*, open woods mostly of *Quercus* in some areas, 17 Jun 1987, *Nesom 6168* (GH, TEX, the GH specimen was annotated in 2005 by R.R. Mill as a previously undescribed species, "Mimophytum sancarlosense," but the name has never been published), Sierra de San Carlos, 17 km al S de San Carlos, Cerro del Diente, 1100 m, bosque mesofilo de montana con *Abies*, *Quercus*, *Staphylea*, 22 May 1988, *Hernandez 2288* (TEX)

A specimen at TEX was annotated in 2005 by R.R. Mill as a previously undescribed species, "Mimophytum brownii," but the name has never been published. The collection was made from near Bustamante, Nuevo León, north of Monterrey, and is identified here as *Omphalodes cardiophylla*. The plant has single flowers on peduncles arising from the base of the plant, but it appears to be an early season form (collected in December) before stems had elongated. Identification of the collection remains tentative, however, as it had not produced fruit and is the northernmost known for *O. cardiophylla*.

5. *Omphalodes mexicana* S. Wats., Proc. Amer Acad. Arts 25: 158. 1890. **TYPE: MEXICO. Nuevo León**. In the Sierra Madre near Monterrey, fissures of dry limerock, 27 Jun 1888, *C.G. Pringle 1878* (holotype: GH!; isotypes: E, F digital image!, K, MO! digital image!, NY-2 sheets digital image!, PH digital image!, RSA, S, US-2 sheets digital image!). The E isotype was annotated in 2005 by R.R. Mill as "Mimophytum mexicanum," but the name has never been published.

Omphalodes mexicana is distinct in its densely pilose-cinereous leaves and stems and peduncles densely strigose to short-pilose proximally to distally with hairs 0.2 0.5 mm long; relatively small leaves usually with a cuneate base; corollas white, limb 5 8 mm in diameter; mericarps glabrous on surfaces and margins, the margins very shallowly, minutely, and irregularly crenate-serrate and strongly inturned to form a flat, shelf-like wing.

Representative collections **MEXICO Coahuila** Mpio Ramos Arizpe, Sierra San Juan de Los Nuncios, base of limestone ridge, 1540 m, common, 2 Apr 1993, *Hinton et al. 22768* (TEX) Nuevo León Mpio Galeana, Cerro El Gallo, limestone rockslide, 2125 m, 15 Jun 1991, *Hinton et al. 21036* (TEX), Monterrey, top of "M" ridge near La Ventura, on rock, 7 May 1960, *Smith M167* (TEX)

6. **Omphalodes carranzae** Nesom, **sp. nov.** Figures 6, 7. **TYPE: MEXICO. Coahuila**. Mpio. Ocampo: Sierra del Carmen, Rcho. Morteros y Rcho. San Isidro, aprox. 178 km de Múzquiz por la brecha Múzquiz-Boquillas del Carmen (carr. 53), 28° 47' N, 102° 30' W, 1300 m, matorral rosetófilo de *Agave lechuguilla*, *Leucophyllum frutescens*, *Prosopis glandulosa*, *Larrea tridentata*, 27 Mar 1993, *M.A. Carranza 1408* with J. Noriega and L. Garcia (holotype: BRIT!; isotypes: ANSM, IEB, TEX!).

Distinct in its combination of perennial-rhizomatous habit (presumably), small, ovate-cordate leaf blades, sparsely strigose stems, blue corollas, and mericarps with low, blunt, minutely papillate teeth and hirsute adaxial surface Different from *O. cardiophylla* in its completely (proximal to distal) strigose stems, blue corollas, and mericarps with low, blunt, minutely papillate teeth Different from *O. chiangii* in its toothed, minutely papillate mericarp margins

Plants perennial, rhizomatous (probably, basal parts not seen). **Stems** lax, ascending to decumbent-ascending, ca. 15–25 cm long, very sparsely strigose proximal to distal with hairs 0.2–0.4 mm long. **Leaves**: blades ovate to broadly ovate or nearly reniform, 5–10 mm long, base cordate, both surfaces hirsute to strigose-hirsute or loosely strigose; petioles 5–25(–60) mm long, strigose. **Inflorescence** bracteate racemes, 6 9-flowered; fruiting peduncles 10 28 mm. **Sepals** oblong-lanceolate, 2.5 3 mm long, loosely stiffly strigose. **Corolla limb** 6 8 mm in diam., without tubercles, blue at least on outer edges, tending to dry white. **Mericarps** 4, monomorphic, flat with an upturned wing, 2 2.5 mm in diam., margins with low, rounded teeth with minutely papillate surfaces, adaxial surface hirsute, abaxial surface completely glabrous.

Flowering Mar–Apr. Desert shrub, oak woodland; 1300–1400 m. Apparently endemic to the Sierra del Carmen in northwestern Coahuila.

Additional collections **MEXICO Coahuila** Mpio Ocampo Sierra del Carmen, Los Lirios, cañon con arroyo temporal, 28° 54 N, 102° 30' W, bosque a la orilla del arroyo de *Quercus fusiformis*, *Q. grisea*, en partes más altas *Q. glaucoides*, *Q. gravesii* con *Juniperus flaccida* y *Crataegus*, 15 Oct 1992, *Villareal 7044* with Vásquez & Carranza (ANSM, XAL)

The new species is named for Miguel A. Carranza Pérez of Saltillo, active collector and student of the flora of Coahuila. Most of his collections are housed at ANSM, Universidad Autónoma Agraria Antonio Narro, Saltillo.

Omphalodes carranzae and *O. chiangii* both are endemic to northwestern Coahuila. The two are unambiguously distinct, as outlined in the contrasts below.

1 Inflorescence bracts distinctly reduced from proximal leaves, mericarps glabrous abaxially, hirsute adaxially, wing upturned, margins with low, rounded teeth, teeth and wing minutely papillate ——— **Omphalodes carranzae**

1 Inflorescence bracts little or not reduced from proximal leaves, mericarps completely glabrous, wing strongly inturned, flat and shelf-like, margins entire ——— **Omphalodes chiangii**

Figure 6 *Omphalodes carranzae*, *Carranza 1408*, holotype BRIT

Figure 7 Mericarps of *Omphalodes carranzae* (left) and *O. cardiophylla* (right) Not to scale, mericarps are 2 3 mm in diam in both species

7. *Omphalodes chiangii* Higgins, Phytologia 33: 412. 1976. **TYPE**: **MEXICO**. **Coahuila**. Sierra del Jardin, Cañon de Centinela, S and SW of Pico de Centinela, steep canyon through mtns of igneous rock, mostly intrusive basics, gravelly, grussy, and sandy soils, chaparrales, and higher on N slopes, 1600 2225 m, *Quercus* spp., *Pinus* spp., *Pseudotsuga*, *Ceanothus*, *Cercocarpus*, 31 Jul 1973, *M.C. Johnston 11975B with T. Wendt, F. Chiang, & D. Riskind* (holotype: LL!; isotype: WTS). The holotype was annotated in 2005 by R.R. Mill as "Mimophytum chiangii," but the name has never been published.

Omphalodes chiangii is distinctive in its foliaceous-bracteate inflorescence, stems sparsely closely strigose with short hairs (0.2 0.4 mm), and completely glabrous mericarps with a strongly inturned, flat, shelf-like, entire-margined wing. It apparently is endemic to the Sierra del Jardin in northern Coahuila.

8. **Omphalodes australis** Nesom, **sp. nov.** Figures 8, 9. **TYPE**: **MEXICO**. **Puebla**. Boca del Monte [S side of Pico de Orizaba], moist, shaded mountain slopes, Jun 1907, *C.A. Purpus 2498* (holotype: UC!, Fig. 8; isotype: GH!, Fig. 9). The GH specimen was annotated in 2005 by R.R. Mill as a previously undescribed species, "Mimophytum australe," but the name has never been published. The GH sheet was annoted in 1976 by L.C. Higgins as *Omphalodes cardiophylla*, and I referred earlier to this collection (but without citing the collection data) as a disjunct population of *O. cardiophylla* (Nesom 1988).

Similar to *Omphalodes cardiophylla* A. Gray but distinct in its strigose stem vestiture proximal to distal with short, tightly appressed hairs, very small corollas, single mature mericarp per flower, mericarp adaxial surface hirsute and wings very narrow, and geographic range disjunct far south of the other species of *Omphalodes*.

Plants perennial, rhizomatous (probably, basal parts not seen). **Stems** lax, decumbent, 12 30 cm, sparsely to moderately strigose proximal to distal, hairs 0.2 0.6(–0.8) mm. **Leaves** basal and cauline or mostly cauline, blades triangular-lanceolate, 8 30 (–50) mm, apex acuminate, base cordate, lower surface densely strigose, upper surface sparsely strigose; petioles 5–30 mm, strigose to loosely strigose proximally. **Inflorescence** bracteate racemes, 6–15-flowered; fruiting peduncles 8–20(–30)

Figure 8. *Omphalodes australis*, *Purpus 2498*, holotype UC.

Figure 9. *Omphalodes australis, Purpus 2498,* isotype GH.

mm. **Sepals** triangular to elliptic-lanceolate, 2 mm, densely stiffly strigose. **Corollas** white, limb ca. 4 mm in diam., without tubercles, tube hardly exserted from calyx. **Mericarps** solitary (3 evidently aborting), flat, 2.5–2.8 mm in diam., upper and lower surfaces hirsutulous, wings very narrow, teeth triangular, cut nearly to base of wing, upturned, hispidulous.

Additional collection examined. **MEXICO**. **Puebla**. Boca del Monte, Aug 1907, *C.A. Purpus 5006* (UC).

Figure 10. Mericarp of *Omphalodes australis*, adaxial surface.

The REMIB database indicates the following specimen to be at XAL, but according to the XAL Director, Dr. Sergio Avendaño Reyes, it is not there. **Veracruz**. Boca del Rio, shaded mountain slopes, [annotated in XAL database as 96° 8' 99", 19° 6' 99", a montane locality different from the coastal city of Boca del Rio, Veracruz], Jun 1907, *C.A. Purpus s.n.* (XAL[?] V029622). This is mapped, speculatively, on Map 4 as *Omphalodes australis*, because of its southern locale and apparent proximity to Boca del Monte, Puebla. The close similarity between the posted label data of V029622 and that of the type collection (*Purpus 2498*) suggests that the data for V029622 may be incorrect, the specimen instead a duplicate of either *Purpus 2498* or *5006*.

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